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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,924	06/24/2003	Shao-Chung Hu	JC-7109-CIP	4337
23900	7590	12/05/2005	EXAMINER	
J C PATENTS, INC. 4 VENTURE, SUITE 250 IRVINE, CA 92618			NGUYEN, THANH T	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 12/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/603,924	HU ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-7 and 31-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-7 and 31-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-2, 4-7, 31-41 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-6, 38-40 are rejected under 35 U.S.C. 102(e) as being anticipated by Small et al. (U.S. Patent Publication No. 2002/0111026).

Small et al. teaches a method of removing contaminants from a silicon wafer after a chemical-mechanical polishing operation, comprising:

Providing a silicon wafer having a layer thereon (paragraph# 41);

Performing a CMP process to remove a portion of the wafer (see paragraph# 10, 33), and

Treating the silicon wafer using an aqueous solution of ozone and providing an inertial mechanical force (see paragraph# 10, 33, 45).

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Regarding to claims 2, wherein a concentration of ozone in the aqueous solution is between 10 ppm and 200 ppm (see paragraph# 10).

Regarding to claims 4, treating the substrate is performed by a water-cleaning process (see paragraph# 10).

Regarding to claim 5, the layer is selected from the group consisting of a low dielectric constant material layer, metallic layer and a barrier layer (see paragraph# 14, 45).

Regarding to claim 6, the aqueous ozone solution is catalyzed to produce more free ozone radicals therein (see paragraph# 43).

Regarding to claim 38, inertial mechanical force is proved by a polishing pad in a buffer CMP station (see paragraphs# 10, 33, 45).

Regarding to claim 38, inertial mechanical force is proved by a polishing pad in a cleaning station (see paragraphs# 10, 33, 45).

Regarding to claim 38, inertial mechanical force is proved by a polishing pad in a metal CMP station (see paragraphs# 10, 33, 45).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 7, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Small et al. (U.S. Patent Publication No. 2002/0111026) as applied to claims 1-2, 4-6, 38-40 above in view of Hirabayashi et al. (U.S. Patent No. 5,575,885).

Small et al. teaches all of the limitation as described in the claim invention above. However, the reference does not teach the aqueous ozone solution is catalyzed by exposure to a beam of ultraviolet light or addition of hydrogen peroxide.

Hirabayashi et al. teach the aqueous ozone solution is catalyzed by exposure to a beam or ultraviolet light or addition of hydrogen peroxide thereto (see col. 14, lines 37-42).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would catalyzed the ozone solution by adding hydrogen peroxide in process of Small et al. as taught by Hirabayashi et al. because catalyzed the ozone solution by adding hydrogen peroxide would produce more free radicals inside the solution and improves cleaning efficiency of the ozone solution.

The specific mechanical force in the cleaning step is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller*, the selection of reaction parameters such as temperature and concentration would have been obvious:

Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed Acritical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.

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In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any mechanical force in the cleaning step suitable to the method in process of Small et al. in order to optimize the process.

Claims 1-2, 4-7, 25-30, 31-32, 35-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirabayashi et al. (U.S. Patent No. 5,575,885) in view of Hsu (U.S. Patent No. 6,096,633).

Referring to figures 8a-12, Hirabayashi et al. teaches a method of removing contaminants from a silicon wafer after a chemical-mechanical polishing operation, comprising:

Providing a silicon wafer (21) having a layer (22/24/25) thereon;

Performing a polishing process to remove a portion of the wafer (24/25, see figure 8b-8c, 15b-15c, col. 9, lines 24-44); and

Treating the silicon wafer with a buffer-polishing process using an aqueous solution of ozone (see col. 12, lines 59-67), providing an inertial mechanical force (dipping is hand pressure) so that contaminants on a surface of the substrate are removed (see col. 15, lines 37-67).

Regarding to claims 2, 32(22), 26 wherein a concentration of ozone in the aqueous solution is between 100 ppm and 200 ppm (see col. 12, lines 59-60).

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Regarding to claims 4, 34 (24), 28, treating the substrate is performed by a water-cleaning process (see col. 12, lines 59-67. Noted that ozone aqueous is ozone in water).

Regarding to claim 5, the layer is selected from the group consisting of a low dielectric constant material layer, metallic layer and a barrier layer (copper interconnect, see col. 12, lines 35-42).

Regarding to claim 6, the aqueous ozone solution is catalyzed to produce more free ozone radicals therein (see col. 14, lines 37-42. Noted that since aqueous ozone solution is known to catalyze by hydrogen peroxide. Therefore, it would produce more free ozone radicals).

Regarding to claim 7, the aqueous ozone solution is catalyzed by exposure to a beam or ultraviolet light or addition of hydrogen peroxide thereto (see col. 14, lines 37-42).

Regarding to claims 1, 25, 29, 31(21), providing an inertial mechanical force (dipping is hand pressure) so that contaminants on a surface of the substrate are removed (see col. 15, lines 37-67).

Regarding to claim 33(23), 27, buffer-polishing process (see col. 12, lines 59-67).

Regarding to claim 36(26), 30, forming a barrier layer (24/35) over the substrate (32/21), wherein the barrier layer is conformal to the surface profile of the substrate and cover the dielectric layer (33/22) before forming a metallic layer (36/25) process but after patterning the dielectric layer process (33), polishing the barrier layer to remove a portion of the barrier layer and expose the dielectric layer after performing polishing step (see figures 13a-13c and 15a-15c).

However, Hirabayashi et al. does not teach polishing the layer by using chemical-mechanical polishing as cited in claims 1, 25, 31(21), and the mechanical force in the cleaning step. Nevertheless, polishing the metal layer by using chemical-mechanical polishing, and the mechanical force in the cleaning step is known in the semiconductor processing art as evidenced by Hsu.

Hsu teaches polishing the metal layer by using chemical-mechanical polishing or etch back (see col. 3, lines 25-30).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would polish the layer by using chemical-mechanical polishing technique in process of Hirabayashi et al. in process of Hsu because chemical-mechanical polishing would provide a metal with planar surface.

The mechanical force in the cleaning step is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller*, the selection of reaction parameters such as temperature and concentration would have been obvious:

Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed Acritical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.

In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any mechanical force in the cleaning step suitable to the method in process of Hirabayashi et al. in order to optimize the process.

Claims 33-34, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirabayashi et al. (U.S. Patent No. 5,575,885) in view of Small et al. (U.S. Patent Publication No. 2002/0111026).

Hirabayashi et al. teaches a process of treating the substrate using aqueous solution of ozone and providing an inertial mechanical force to remove the contaminant from the surface of the substrate. However, the reference does not teach the inertial mechanical force is by polishing pad in a buffer CMP station, cleaning station, and metal CMP station.

Small et al. teaches treating the substrate using aqueous solution of ozone and provide mechanical force by using polishing pad in buffer CMP station, cleaning station, and metal CMP station to remove the contaminant from the surface of the substrate (see paragraphs# 10, 33, 45).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would treating the substrate using aqueous solution of ozone and provide mechanical force by using polishing pad in buffer CMP station, cleaning station, and metal CMP station in process of Hirabayashi et al. as taught by Small et al. because the process would remove the contaminant from the surface of the substrate to provide a substrate surface with free contaminants.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-2, 4-7, 25-30, 31(21)- 36(26) are stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8 of U.S. Patent No. 6,696,361. Although the conflicting claims are not identical, they are not patentably distinct from each other because both the present invention and the patent application claim a substrate (wafer) having dielectric layer, barrier layer, metal layer, CMP to remove a portion of the wafer, treating the wafer with a buffer-polishing process using an aqueous solution of ozone.

Response to Arguments

Applicant's arguments with respect to claims 1-7, 31-41 have been considered but are moot in view of the new ground(s) of rejection.

Applicant contends that Hirabayashi et al. does not teach treating the substrate using an aqueous solution of ozone and providing an inertial mechanical force. In

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response to applicant that Hirabayashi et al. clearly teach treating the substrate using an aqueous solution of ozone and providing an inertial mechanical force (dipping is hand pressure called inertial mechanical force) (see col. 15, lines 37-67).

Applicant contends that Hirabayashi et al does not teach treating the substrate using aqueous solution of ozone and provide mechanical force by using polishing pad in buffer CMP station, cleaning station, and metal CMP station to remove the contaminant from the surface of the substrate. In response to applicant that Small et al. teaches treating the substrate using aqueous solution of ozone and provide mechanical force by using polishing pad in buffer CMP station, cleaning station, and metal CMP station to remove the contaminant from the surface of the substrate (see paragraphs# 10, 33, 45).

Applicant traverses the double patenting rejection:

Applicant contends that the present invention restricted by “providing an inertial mechanical force” in addition to “using the aqueous solution of zone” while the parent application only uses an aqueous solution of ozone. In response to applicant that claim 1 of the parent application are open to the inclusion of additional process steps and conditions in the claimed methods, even between the enumerated process steps, which do not interfere with the order of the process steps as set forth in these claims. In re Baxter, 656, F.2d 679, 686-87, 210 USPQ 795, 802-03 (CCPA 1981). Which means that it can the step of “providing an inertial mechanical force” can be included in the claim.

Applicant contends that the parent application restricted to “damascenes structure”. In response to applicant that claim 31 of the present invention is restricted to damascenes structure.

At least for the above reasons, the present invention and the parent application are

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not patentably distinct from each other.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal stroke extending to the left.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN